

- (c) after a portion of the conductive material has been deposited, depositing an impurity which does not migrate out of the contact hole onto the conductive material at a temperature that causes the conductive material to reflow, the impurity causing the surface tension of the conductive material to lower.

REMARKS

Prior to the present Amendment, claims 1 and 30-65 were pending in the Application. In this Amendment, the Applicant has cancelled claims 36, 45, 57 and 63, without prejudice. Claims 1, 30, 40, 48 and 60 have been amended. Accordingly, claims 1, 30-35, 37-44, 46-56, 58-62, 64 and 65 are currently pending in the Application.

In the Office Action, the Examiner rejected claims 1, 30-36, 37-41, 43-45, 47-57, 59-61, 63 and 64 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,897,370 to Joshi et al. ("the Joshi reference"). Claims 37, 46, 58 and 64 were rejected under 35 U.S.C. § 103(a) based on the combination of Joshi and U.S. Patent No. 5,962,923 to Xu ("the Xu reference"). Claims 42 and 62 were rejected under 35 U.S.C. § 103(a) the combination of Joshi and U.S. Patent No. 6,040,020 to Sandhu ("the Sandhu reference"). Finally, claims 47 and 65 were rejected under the judicially created doctrine of obviousness-type double patenting based on U.S. Patent No. 6,281,104, which issued from an application that is related to the present application.

The rejections of claims 36, 45, 57 and 63 have been rendered moot by the cancellation of those claims. Accordingly, claims 36, 45, 57 and 63 are not discussed further herein.

The Double Patenting Rejection

With respect to the double patenting rejection of claims 47 and 65, the Applicant assumes that the rejection was intended to be based on U.S. Patent No. 6,281,104, which issued from a predecessor of the present application. The Office Action actually states that the rejection is based on U.S. Patent No. 6,287,104, which is not the Applicant's patent. The Applicant assumes that the reference to U.S. Patent No. 6,287,104 in the Office Action was a typographical error.

The Applicant reserves the right to contest the double patenting rejection on the merits when the presence of allowable subject matter is indicated. Accordingly, the double patenting rejection of claims 47 and 65 is not discussed further herein.

The Rejections Under 35 U.S.C. § 102

As set forth above, the Examiner rejected claims 1, 30-36, 37-41, 43-45, 47-57, 59-61, 63 and 64 under 35 U.S.C. § 102(e) as anticipated by the Joshi reference. Specifically, the Examiner stated:

Claims 1, 30-36, 37-41, 43-45, 47-57, 59-61, 63, and 64 are rejected under 35 U.S.C. 102(e) as being anticipated by Joshi, et al. (US 5,897,370)("Joshi").

Joshi discloses the steps of providing a substrate comprising a contact hole in a dielectric layer which exposes a portion of the substrate(col. 6, lines 46-55 and 65-67), depositing conductive material comprising aluminum(col. 5, lines 35-48), depositing an impurity into the conductor which lowers the melting point of the conductor and reflowing. The impurity comprises Ge, the temperature of the reflow is within the range recited in the instant claims (col. 8, lines 1-8).

Office Action, page 3.

The Applicant respectfully traverses the rejection of the pending claims. Anticipation under section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under section 102, a single reference must teach each and every element or step of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984). Thus, if the claims recite even one element not found in the cited reference, the reference does not anticipate the claimed invention.

In the present case, independent claims 1, 30, 40, 48 and 60 recite that the introduction of impurities into the conductor region occurs “after a portion of the conductive material has been deposited.” This limitation is not taught, suggested or illustrated by Joshi. In fact, Joshi makes no mention that introducing impurities partially through the process of forming the conductive layer is desirable.

For at least these reasons, Joshi does not anticipate the Applicant’s present claims. Accordingly, the Applicant respectfully requests withdrawal of the rejection of claims 1, 30-36, 37-41, 43-45, 47-57, 59-61, 63 and 64 under Section 102 based on Joshi.

The Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 37, 42, 46, 58, 62 and 64 under 35 U.S.C. § 103(a) as being obvious over Joshi in view of Xu or Joshi in view of Sandhu. Specifically, the Examiner stated:

Claims 37, 46, 58, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joshi et al as applied to claim 30 above and further in view of Xu, et al (US 5,962,923).

Joshi does not teach intermittent deposition of the impurity.

Xu teaches the intermittent deposition of the impurity as shown in Fig. 1 and described in col. 7, lines 20-45 as the carrier layer. The carrier layer allows a low reflow temperature for the filling of the opening (col. 7, lines 48-60).

One of ordinary skill in the art would have been motivated to have carried out the impurity deposition intermittently in the process taught by Joshi as taught by Xu in order to obtain the same lowering of the reflow temperature as is achieved by the process taught by Joshi.

Claims 42 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joshi et al in view of Sandhu et al (US 6,040,020).

Joshi does not teach GeF₄.

Sandhu teaches the equivalence of GeH₄ and GeF₄ for a dopant (col. 4, lines 35-45).

One of ordinary skill in the art would have been motivated to have used GeF₄ in the process taught by Joshi in view of the teaching by Sandhu of the equivalence of GeF₄ and GeH₄ as dopants.

Office Action, pages 3-4.

The Appellant respectfully traverses these rejections. The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221

U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

In the present case, there can be no *prima facie* case of obviousness. All of the rejections under Section 103 are based on Joshi. As set forth above, Joshi does not teach, suggest or illustrate the requirements of independent claims 1, 30, 40, 48 and 60, and the claims dependent thereon. This is true for at least for the reasons set forth above with respect to the rejections under Section 102. Namely, independent claims 1, 30, 40, 48 and 60 recite that the introduction of impurities into the conductor region occurs “after a portion of the conductive material has been deposited.” This limitation is not shown in Joshi, nor any of the other references cited by the Examiner, including Xu and Sandhu. Thus, the combination of Joshi with either Xu or Sandhu cannot render the pending claims obvious under Section 103.

For at least these reasons, the Applicant respectfully submits that claims 37, 42, 46, 58, 62 and 64 are not obvious over Joshi in view of either Xu or Sandhu. Accordingly, the Applicant

respectfully requests the withdrawal of the rejections of claims 37, 42, 46, 58, 62 and 64 under Section 103 based on the combination of Joshi with Xu and Sandhu.

If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Payment of Fees

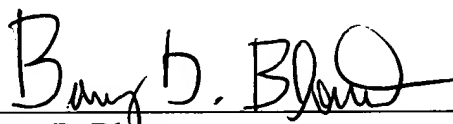
This response is timely filed and does not present claims that require payment of a fee at this time. Accordingly, the Applicant respectfully submits that no fees are due at the present time.

General Authorization for Extensions of Time

In accordance with 37 C.F.R. § 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefor. Furthermore, Applicants authorize the Commissioner to charge the appropriate fee for any extension of time to Deposit Account No. 13-3092; Order No. MCRO:199--3/FLE (95-0057.03).

Respectfully submitted,

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